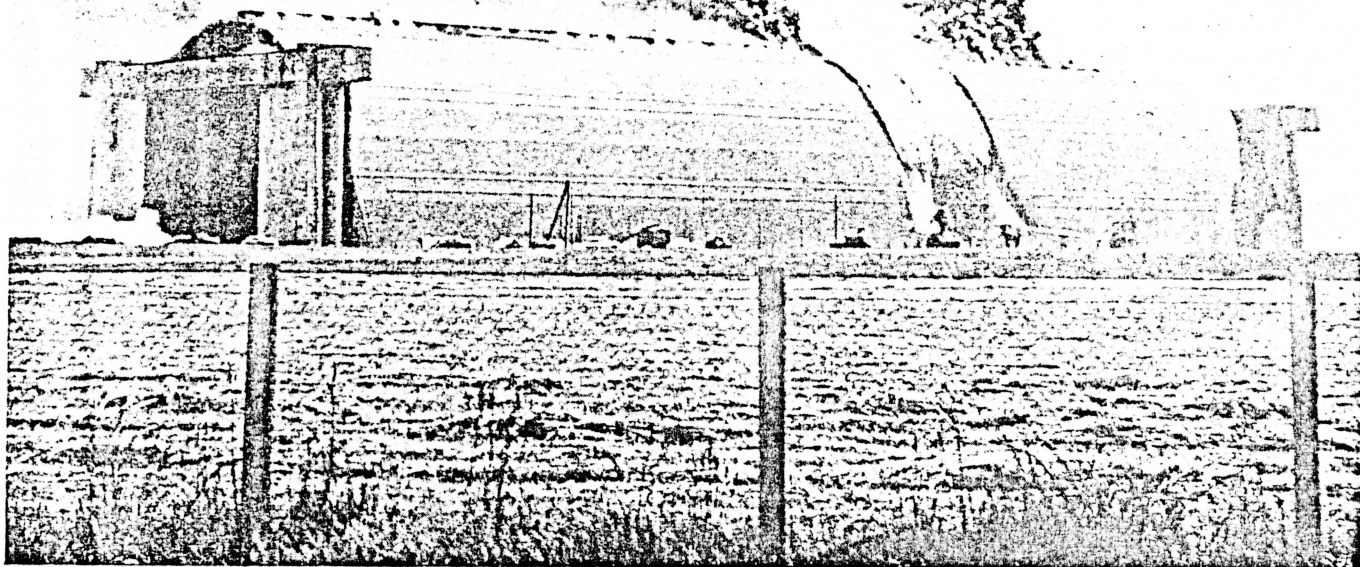




Former Navy blimp hangar at Tillamook, Ore., occupied by Diamond Lumber Co., caught fire last August. Immense size

of building dwarfs automobiles and dust collectors outside. Roof is 1,000 ft. long and 170 ft. high at crown.

Everybody said:

'There she goes!' But she didn't

A dramatic account of how pressure treated fire retardant timber construction prevented disaster to huge hangar

Fire retardant wood prevented a raging fire from destroying a blimp hangar worth millions in Tillamook County, Ore., last August. One hour after the blaze broke out and raced up the outside roofing, it was brought under control despite severe handicaps.

Whipped by wind, the fire quickly reached to the roof crown, 170 ft. high, where local water pressure could reach only intermittently. When water pressure was increased, firemen could not hold the hoses, and no turret nozzles were available. Nevertheless about an hour after the fire started, fire fighters succeeded in lugging hose lines to the roof, and soon the spread of flame was checked and smoldering sections were slowly extinguished.

Damage was limited to 40,000 sq. ft. of roofing, and repairs cost only \$21,000, much less than 1 per cent of the \$6 million it would have cost to replace the entire building. There was no damage to the structural timbers except for a shallow char. Contrast this with the familiar fire report be-

ginning "excessive area and rapid fire spread" and ending "total loss."

In describing the reaction of spectators, one of our correspondents declared that firemen and onlookers alike marvelled that the intensity of the fire had so little effect upon the supporting timber structure. All agreed that without pressure treated fire retardant lumber, the huge building would have been reduced to a heap of debris very shortly.

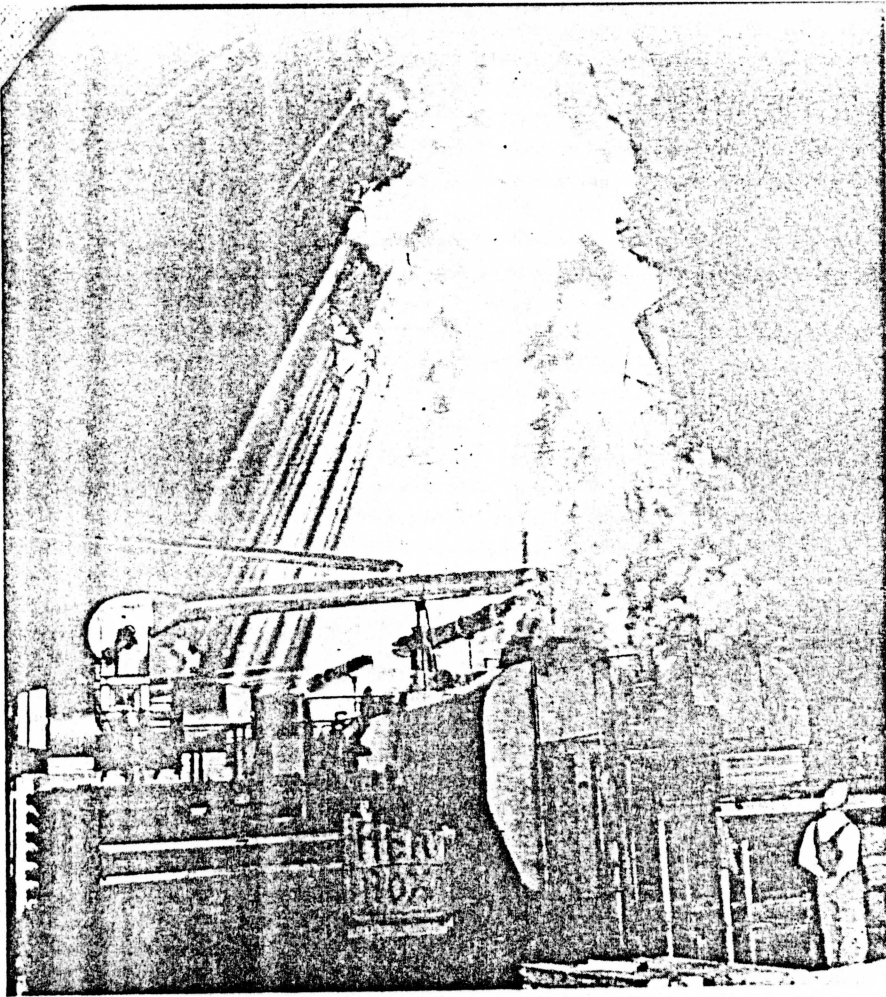
The building was one of a number of blimp hangars built by the Navy during World War II along the Atlantic, Pacific, and Gulf coasts. It is located 80 miles west of Portland, Ore., at Tillamook.

Fire protection

An adequate arrangement of outside hydrants on mains supplied from a large reservoir located in the hills back of the air base was provided in the original installation. These were still in service at the time of the fire so there was no shortage of available water supplies. In the original construction, the shop areas on both

sides of the hangar (located in the concrete base structures of the timber arches) were completely equipped with sprinklers. However, during the intervening years, lack of maintenance resulted in freeze-ups, broken fittings, and similar deficiencies to the extent that the sprinkler systems had been shut off and discontinued for some time. There was no sprinkler system or other form of automatic protection in the hangar proper. There were four hose houses located along the catwalk of the roof of each hangar, containing standard 1-1/2-in. hose and nozzles and supplied by a 4-in. standpipe running down the side of the roof to the base where a siamese connection was provided. But static pressure in the water mains was not high enough to provide water to the roof without pumps.

After the war the Navy leased the airport and the two hangars at Tillamook to Tillamook County. The county, in turn, subleased the buildings. The one which caught fire was occupied by a lumber and plywood manufacturer, Diamond Lumber Co.



Smoke and steam rise from dryer inside building due to shutdown of the blower system. No fire occurred in the dryer, but flames from burning roof billowed up inside hanger.

made by the intersection of the monitor and roof.

Upon receiving alarms sent from the Navy base, the City of Tillamook Fire Dept. and the Tillamook Rural Fire Protection District, which operate together as a single unit, dispatched three fire trucks which arrived quickly over three miles of good roads. In addition there were two more fire trucks and two tank trucks which came to the scene under the Tillamook County Mutual Aid agreement, which provides for mutual aid response from several small towns near the air base. The tank trucks have small hoses used in fighting forest fires. In all, 24 regular volunteer and paid firemen responded, and a large group of plant employees were on hand to help.

Fighting the fire

Firemen working with hydrant hoses and pumper streams from the ground and from the top of two platforms supporting dust collectors outside the hangar managed to suppress the fire on the lower part of the roof. But their hose streams reached only one-third of the way up the giant roof. Another crew was on the inside trying to reach the underside of the roof with pumper streams, but be-

cause of the extreme height could get only brief spurts of water up to the top part of the inside fire area.

When water pressure was increased to provide longer streams, the men were unable to hold the hoses, and none of the local equipment included any form of turret nozzle. About an hour after the fire broke out hose

lines were carried to crews on the roof, and the blaze was soon brought under control.

In the meantime the fire had charred through a 30x20-ft. area of the treated 2-in. roof decking about halfway up the building. This was the area most difficult to reach with hose streams.

Untreated runway burns

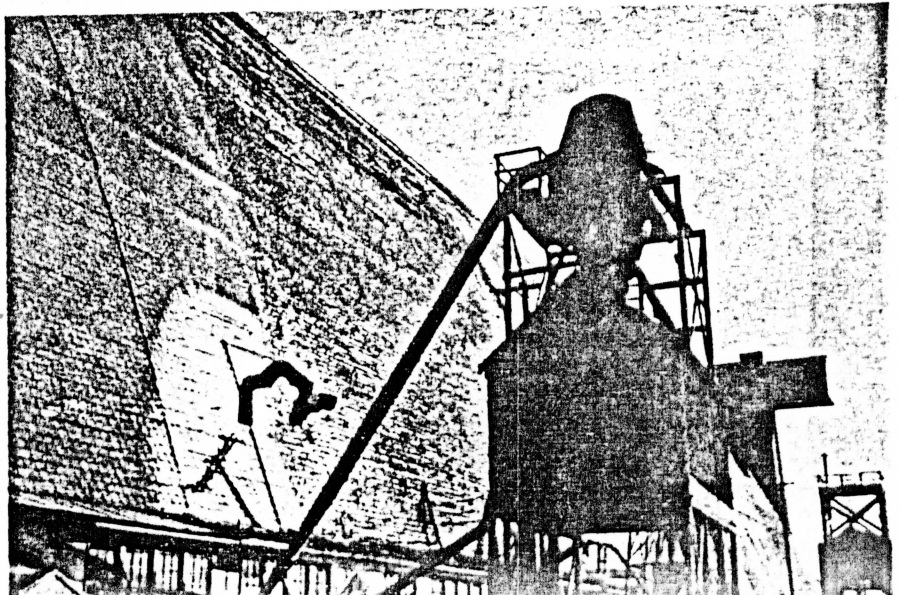
The opening acted like a flue so that a portion of the flame from the burning roof billowed inside the hangar and was exhausted along the monitor. This flame on the inside probably ignited the untreated runway in the monitor, which was slowly destroyed along its length. It is known that this runway was not pressure treated with fire retardant chemicals, but it has been reported as having been brush treated with fire retardant paint. If so, the effectiveness of this early type of fire retardant paint probably had deteriorated in the moist, coastal climate of Tillamook County.

Even after the major roofing blaze was under control, there remained slow slippery work on the sloping sides of the building, using safety ropes and hose to put out the smoldering fires in between the layers of roofing. More than two hours after the alarm, some of the fire trucks were able to leave the scene. But for several more hours, little smoldering spots kept breaking out. Seven hours after its start, all fire apparently was extinguished.

Conclusions drawn

A study of fire damage and behavior of the material testifies to the value and effectiveness of fire retardant

Fire started in exhaust duct, seen here broken off. Shiny spot on roof around ducts marks area moistened by sprinkler system. Unfortunately, sprinklers did not come into play until fire was well under way, since it started at the outer end of the exhaust duct.



Equipment inside the hangar included machinery for remanufacturing lumber, resaws, planers, and the like. There was also a plywood plant comprising a veneer lathe, veneer dryer, glue press, other necessary machinery, and stocks of lumber and plywood. Total value of the equipment and inventory in the building was estimated to be in excess of \$1.5 million. Damage to equipment, mostly from water, was approximately \$4,500. As there was no flash fire inside the building, it is probable that the extraordinary height had averted the deposit of sawdust and dirt on the framing members of the structure.

Plywood veneer dryers use relatively high temperatures and are a potential source of fire. Therefore, automatic deluge-type sprinklers are built into this type of equipment for fire protection. Moisture and residue from the dryers are expelled through a duct to outside atmosphere. In this instance horizontal vent ducts were carried through the side of the building because the great height of the structure made the vertical type impractical. Because the horizontal duct reduced natural draft, an exhaust fan was installed in the duct 10 to 12 ft. inside the wall of the building.

The fire started among residues deposited in the short portion of one of the ducts near its outside end. In the absence of a pilot sprinkler head at the end of the duct, the fire



Inside the hangar men with hoses could not reach middle section of roof, except with momentary spurts of water. Here the fire burned intensely about one hour. Even so, no fire spread inside the roof and no framing members were damaged.

burned freely until noticed. Then a manual release on the sprinkler system was operated. By this time, a strong wind, blowing toward the hangar, had directed the torch-like flame from the duct against the side of the building and ignited the roof covering.

As soon as the fire was discovered, the plant was shut down, the alarm was given, and plant employees began fighting the fire with hoses attached

to outside hydrants. However, the height of the building limited action to the base of the fire because of low hydrant pressure. Before long the fire had swept up the side of the building and had spread downwind. It fed on an untreated wooden catwalk on top of the monitor and windswept sawdust and shavings that had packed under the catwalk. Fire also spread to more dust and debris in the valley

Construction detail of Tillamook hangers—dimensions, materials, fire retardant treatment

The two hangars at Tillamook each have an egg-shaped roof shell, stiffened with a series of transverse arch ribs. Each building is 1,000 ft. long, 170 ft. high at the crown, and has an overall width at the ground of about 296 ft. By reason of dimensional magnitude and the volume of lumber used, they are said to be the largest buildings in the world framed of timber.

The arch ribs are of the open-web truss type, spaced on 20-ft. centers. Each rib is supported on reinforced concrete abutment bents 24 ft. high. The concrete bents provide unobstructed shop and office space along each side of the building. The timber arch ribs are a constant 18½ ft. in depth, except at the base anchorage to the concrete bents where they flare to 19 ft. Panel lengths of the truss system are about 12 ft. along the extrados and 11½ ft. along the intrados of the ribs. Chords vary from two 3x12 to two 4x12-in. pieces, the web diagonals from two 3x8-in. pieces, and the web verticals from one 4x8 to one 6x8-in. piece.

Purlin trusses at each panel point span the 20-ft. distance between arch ribs. The top chord of the purlin truss is a 3x10. There are two diagonals connected at the center of this chord to halve its span and to serve as sway bracing between arches. The bottom chord of the purlin truss also serves as a strut between arches. The 3x12-in. rafters are supported at 6-2/3-ft. centers on the purlins, and the roof is sheathed with 2-in. tongue-and-groove planking. The sheathing constitutes the main bracing for the top chord of the arch ribs, but this is supplemented by "V" bracing in the lower part of the building height. In the plane of the bottom chord of the arch ribs, cross bracing is placed in every other bay. Both split-ring and shear-plate timber connectors were used liberally in the joining of members.

Two interior catwalks run the length of the hangar, one on each side, at a height of 137 ft. above ground. Stairways at each end of the hangar lead from the ground to the cat-

walks and thence to the roof, and a middle stairway leads to the catwalks only. A monitor runs the full length of the ridge of the building.

All structural lumber and the deck plank were pressure impregnated with Minalith and Protexol, chemicals for high fire retardance. Federal specifications under which the salts were manufactured and applied are similar to those in use today (MIL-C-2865 and MIL-C-2799). Because of the large volume of treated timber products required to meet a wartime emergency, the material was treated at some 50 different plants.

Although the main structure was all pressure treated, the roof catwalk and hose houses and some of the original construction between the concrete bents on each side were only brush painted with retardants after erection. Subsequent additions, revisions to construction along the sides and all interior platforms and construction installed by the woodworker were of untreated lumber. Except for the roof catwalk and hose houses which did contribute slightly to the horizontal flame spread, none of the brush treated or untreated construction was involved in the fire.

Roofing applied at the time of construction was of two types. Roll roofing 36-in. wide was laid horizontally with each strip overlapping the lower one, shingle fashion, by 19-in. on the side slopes almost to the top of the hangar. The exposed portion 17-in. wide was mineral surfaced, and the lapped portion was cemented to the undercourse. On the upper section of the deck, the lap was mopped with hot asphalt to the undercourse, and galvanized roofing nails were used to fasten the roofing to the sheathing. Built-up roofing comprising four plies of asphalt felt, each ply mopped with hot asphalt, was applied to the flatter section of the roof deck. Recently, the original roofing was covered with an application of asphalt felt shingles with a mineral surface.